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FAX COVER SHEET

Company: USPTO-GAU 2874 From: Wendy W. Koba

Attention: Michelle Connelly-Cushwa Date: 7/23/03

Fax No.: 703-746-4762

Re: App. No. 10/079,668

Number of pages including cover sheet: 7

Michelle,

Attached please find my proposed amendments to the spec. & claims for this application.

I'll be in the office all afternoon, so call me at your convenience.

Thanks—

Wendy

Michelle,

The following are my proposed amendments to the specification and claims for App. No. 10/079,668. I'll wait to hear from you this afternoon...thanks for your help

Wendy

Paragraphs beginning at line 19 of page 129:

FIGs. 69, 70 and 71 show three other embodiments of hybrid active electronic and optical circuits 6502. FIGs. 69, 70, and 71 are each top views of their respective devices. The basic purpose of each of the hybrid active electronic and optical circuits 6502 shown in FIGs. 69, 70, and 71 is to couple light from a relatively wide (i.e., greater than 100 μm) input waveguide 6901 into a relatively narrow (i.e., less than 3 μm) waveguide 6904. ~~The tapered~~ A gap region 6906b is used to evanescently couple light into waveguide 6904. The three FIGs. 69, 70, and 71 show three different ~~techniques~~ passive optical elements that may be used to accomplish the task of changing the direction of incident light within relatively wide input waveguide 6902 into an angle suitable for evanescent coupling into relatively narrow waveguide 6904. These deflection angles can be computed using computational tools such as FDTD.

In the embodiment of FIG. 69, ~~deviation~~ deflection is due to a grating 6902 being integrated into the Si layer during manufacture. In the case of FIG. 70, a waveguide prism 7002 created by altering the effective mode index of the Si layer in a manner such that the shape of a prism is created. In the embodiment of FIG. 71, a waveguide lens 7102 is used. The relatively narrow waveguide 6904 may contain an active optical device.

During (or before/after) the deposition of the desired silicon and electrical insulators in the active electronic portion 6504, the optical insulator materials are deposited in ~~the~~ an insulator strip 6906a and evanescent coupling region 6906b. In accordance with the present invention, evanescent coupling region 6906b may be formed to include a tapered gap portion, or a uniformly shaped gap portion, and may comprise a thickness on the order of 0.5 μm. Similarly, the etching of the silicon material for, and deposition of the desired material to form, the active electronic portion 6504 can occur

simultaneously with the corresponding etching and deposition of the materials to form the passive optical portion 6506. The waveguide 6904 may additionally be considered as a passive optical portion.

The embodiment of hybrid active electronic and optical circuit 6502 shown in FIG. 69 includes a waveguide grating 6902 to couple impinging light from relatively wide input waveguide 6901 into the relatively narrow waveguide 6904 through evanescent coupling region 6906b. The waveguide grating 6902 is configured such that impinging light 6920 from relatively wide input waveguide 6901 is deflected at a suitable angle so the deflected light 6922 enters the relatively narrow waveguide 6904 at a suitable mode angle θ_M. The waveguide grating 6902 is a passive optical portion 6506, and can be controlled by active electronics 6504 to control the angle of deflection, as described herein. Alternatively, the waveguide grating 6902 can be configured as a purely passive device that deflects the light being applied to the waveguide 6904 to the mode angle.

FIG. 70 shows another embodiment of hybrid active electronic and optical circuit 6502 shown in FIG. 69, except that the waveguide prism 7002 has been incorporated in place of the waveguide grating 6902. Similarly, the waveguide prism 7002 is a passive device, that deflects the light being applied to the waveguide 6904 in a mode angle θ_M. The use of the active electronic component 6504 allows adjustability of the light flowing through the waveguide prism 7002, thereby allowing light flowing through the waveguide prism 7002 to be controllably directed at a desired controllable angle to the relatively narrow waveguide 6904.

The material of waveguide prism 7002, the active electronic portion 6504, ~~and~~ the insulator strip 6906a and evanescent coupling region 6906b can all be etched, and the corresponding layers deposited, simultaneously. Different photoresists and masks may allow different materials to be deposited in each of the areas being etched, however, a sequence of all the deposition steps and etching steps that comprise all the processes performed on all of the optical portions and electronic portions, may be performed simultaneously. If a specific material is being deposited on one portion (but not another), or etched on one portion (but not another), then the corresponding masks and etching or deposition tools will be configured accordingly. FIG. 71 shows another embodiment of

hybrid active electronic and optical circuit 6502 in which full waveguide lens 7102 is formed in the upper most silicon layer of the SOI wafer 6600 in place of the waveguide prism 7002 shown in the embodiment of FIG. 70.

Claim Amendments:

12. *(currently amended)* A hybrid active electronic and optical circuit integrated within a Silicon-On-Insulator (SOI) wafer, the SOI wafer including an insulator layer and an upper silicon layer having a thickness of less than 2μm, the hybrid active electronic and optical circuit comprising:

a relatively narrow waveguide located within the upper silicon layer of the SOI wafer for supporting the propagation of light, said relatively narrow waveguide having a width of less than 3 μm;

an active electronic circuit positioned proximate the waveguide, wherein a flow of light through the waveguide can be altered depending on a property of the active electronic circuit;

a light deflector at least partially located in the upper silicon layer, the light deflector is configured to deflect light impinging at the suitable incident angle to a suitable mode angle where light deflected by the light deflector enters the relatively narrow waveguide; and

an evanescent coupling region at least partially located within the upper silicon layer, the evanescent coupling region including a gap region positioned between the light deflector and the relatively narrow waveguide for optically ~~couples~~ coupling the deflected light ~~coupling portion~~ into the waveguide, such that light emitted from the light deflector ~~coupling portion~~ can pass via the evanescent coupling gap region to the relatively narrow waveguide at a suitable mode angle~~; and~~

~~a light deflector at least partially located in the upper silicon layer, the light deflector is configured to deflect light impinging at the suitable incident angle to a suitable mode angle where light deflected by the light deflector enters the waveguide~~.

13. – 14. ***cancelled***

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15. *(currently amended)* The hybrid active electronic and optical circuit of claim 12, wherein the evanescent coupling gap region includes a substantially constant thickness gap portion.

16. *(currently amended)* The hybrid active electronic and optical circuit of claim 12, wherein the evanescent coupling gap region ~~is at least partially formed~~ using an ~~optically clear adhesive~~ includes a tapered gap portion.

17. ***cancelled***

18. *(original)* The hybrid active electronic and optical circuit of claim 12, further including at least one optical device, wherein altering an electric voltage applied to the active electronic circuit affects a free carrier distribution in a region of the at least one optical device, and thereby changes an effective mode index of the at least one optical device.

19. ***cancelled.***

20. *(currently amended)* The hybrid active electronic and optical circuit of claim 12, wherein the evanescent coupling gap region has a thickness of less than 0.5μm.

21. – 28. ***cancelled***

29. *(original)* The hybrid active electronic and optical circuit of claim 12, wherein the hybrid active electronic and optical circuit includes a Fabry-Perot cavity.

30. *(original)* The hybrid active electronic and optical circuit of claim 12, wherein the hybrid active electronic and optical circuit includes a wavelength division multiplexer modulator.

31. *(original)* The hybrid active electronic and optical circuit of claim 12, wherein the hybrid active electronic and optical circuit includes a diode.

32. *(original)* The hybrid active electronic and optical circuit of claim 12, wherein the hybrid active electronic and optical circuit includes a transistor.

33. – 36. ***cancelled***

37. *(original)* The hybrid active electronic and optical circuit of claim 12, wherein the hybrid circuit includes one from the group of a p-n device, a field plated device, a Schottky device, a MOSCAP, and a MOSFET.

38. *(currently amended)* A hybrid active electronic and optical circuit integrated within a wafer, the water including an insulator layer and an upper silicon layer, the hybrid active electronic and optical circuit comprising:

a waveguide located within the upper silicon layer of the SOI wafer for supporting the propagation of light;

an active electronic circuit positioned proximate the waveguide, wherein a flow of light through the waveguide cán be altered depending on a property of the active electronic circuit;

a light deflector at least partially located in the upper silicon layer, the light deflector configured to deflect light impinging at the suitable incident angle to a suitable mode angle where light deflected by the light deflector enters the relatively narrow waveguide; and

an evanescent coupling region at least partially located within the upper silicon layer, the evanescent coupling region including a gap region positioned between the light deflector and the relatively narrow waveguide for optically ~~couples~~ coupling the deflected light ~~coupling portion~~ into the waveguide, such that light emitted from the light deflector ~~coupling portion~~ can pass via the evanescent coupling gap region to the relatively narrow waveguide at a suitable mode angle~~; and~~

~~a light deflector at least partially located in the upper silicon layer, the light deflector is configured to deflect light impinging at the suitable incident angle to a suitable mode angle where light deflected by the light deflector enters the waveguide~~.

39. *(new)* The hybrid active electronic and optical circuit of claim 12, wherein the light deflector comprises an optical grating formed in the upper silicon layer.

40. *(new)* The hybrid active electronic and optical circuit of claim 12, wherein the light deflector comprises an optical prism formed in the upper silicon layer.

41. *(new)* The hybrid active electronic and optical circuit of claim 40 wherein the light deflector comprises regions of different effective mode indices to create a prism-like region in the upper silicon layer.

42. *(new)* The hybrid active electronic and optical circuit of claim 12, wherein the light deflector comprises an optical lens formed in the upper silicon layer.

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